



Storm Water Quality: Activities

Introduction to Storm Water Quality: Activities3

Management & Maintenance Activities.....5

Pesticide & Fertilizer Application	7
Recycling	11
Street Cleaning.....	13
Road Deicing	17
Domestic Animal Waste	21
Vehicle & Equipment Maintenance & Washing Areas	23

Education & Public Outreach29

Public Participation (<i>to be released later</i>)	31
Education	33
Storm Drain Marking.....	39

Regulatory Program Implementation43

Ordinances (<i>to be released later</i>).....	45
Compliance & Enforcement (<i>to be released later</i>).....	47

Above photo source: Indiana Project WET, Indiana DNR

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INTRODUCTION TO STORM WATER QUALITY: ACTIVITIES

Storm water management activities include a variety of measures that are specifically targeted to the reduction of pollution. Typically, these activities can be characterized as source controls. Source controls focus on activities that limit the generation of pollutants at the source rather than the treatment of runoff. This can be achieved through effective and innovative planning, education and public outreach, and the day-to-day actions of the public, businesses, and government.

The remainder of this chapter will focus on management and maintenance activities, education and public outreach initiatives, and finally, regulatory program implementation.

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MANAGEMENT & MAINTENANCE ACTIVITIES

In addition to project site design considerations, pollutants can be reduced through project management, operational procedures, and program implementation. These measures are often referred to as source controls. Source controls focus on activities that limit the generation of pollutants at the source rather than the treatment of runoff. Source controls include day-to-day activities and include but are not limited to trash recycling/disposal, washing of equipment and vehicles, and periodic street sweeping. Through their day-to-day activities, private citizens can play a very important role in protecting water quality by collecting and properly disposing of pet waste, reducing and/or properly applying fertilizers and pesticides, participating in neighborhood recycling programs, and properly disposing of household chemicals and wastes.

This section of the manual contains several source control storm water management measures which can be used to effectively reduce the amount of pollutants generated or their introduction into storm water runoff. It is important to keep in mind that these source controls should be part of an integrated storm water management program. They should not be substituted for the implementation of effective permanent storm water quality measures.

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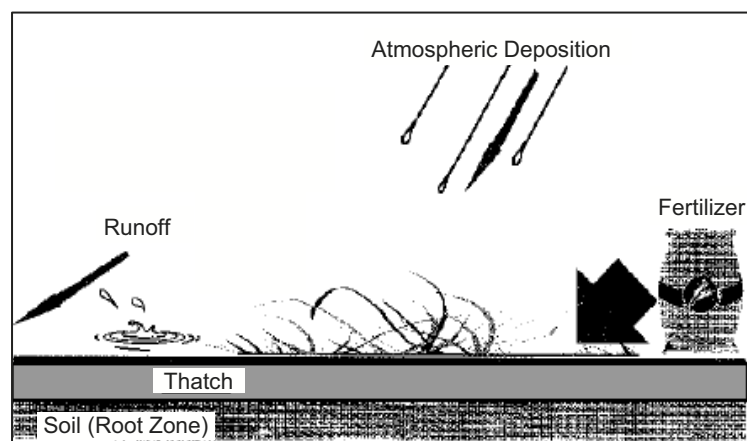
MANAGEMENT & MAINTENANCE ACTIVITIES

Pesticide & Fertilizer Application

Pesticides and fertilizers are a mixture of chemical substances (many containing toxic materials) and nutrients used on the lawns of homeowners, businesses, industries, and agricultural areas. Nonpoint source pollutants commonly associated with both rural and urban runoff are often from pesticide and fertilizer usage (see Figure 1). Monitoring of urbanized areas has shown a link between chemicals found in lawn care products and urban water quality via surface or ground water. The U.S. Environmental Protection Agency estimated in 1979 that homeowners used 87 million pounds of pesticides annually. Minimizing the impact of nonpoint source pollution is a goal involving the cooperation of everyone.

The proper use of fertilizers and pesticides is critical to minimize impacts to the environment. Management measures associated with this issue are considered source controls and are dependent upon citizens, businesses, municipalities, and government agencies managing day-to-day activities.

Figure 1: Fertilizer Pathway to Urban Streams



Source: Center for Watershed Protection, 2000

Application

Pesticides

Pesticides are defined as chemical compounds used for the control of undesirable plants, animals, or insects. The term includes insecticides, herbicides, algicides, rodenticides, nematocides, fungicides, and growth regulators. These chemicals are typically applied to target specific nuisance plants and organisms. The misapplication or overapplication of pesticides may cause chemicals to leach into the ground water or be transported into surface waters. These compounds can potentially have the same effect on plants and organisms living in the ecosystem that received the runoff as it would have had on the targeted treatment area.

Most products that are purchased through a retailer by homeowners are usually formulated for general use. Commercially available pesticides are formulated at

PESTICIDE & FERTILIZER APPLICATION

a greater strength and are considered restricted-use products. It is important that those applying pesticides follow the instructions on the label. Restricted-use products require certification and qualifications through appropriate state authorities that have administrative oversight.

Crews associated with businesses, municipalities, governmental agencies, and others should be trained in the application and proper handling of pesticides and, when required, properly certified and licensed.

If there is no other alternative but to use pesticides, the following practices will reduce the amount and impact pesticides have on the environment.

- Select the pesticide to target specific pests.
- Apply according to the label. Do not misapply or overapply pesticides.
- Do not apply pesticides as a preventive measure. Only apply pesticides if absolutely necessary and if a problem exists.
- Do not apply pesticides prior to a rainfall event.
- Avoid application under windy conditions to avoid drift.
- Use pesticides applications that will reduce drifting.
- Use pesticides that are incorporated into the soil.
- Consider the area to which the application will occur and the environmental conditions or potential hazards associated with the application.
- Always store, clean, and dispose of pesticides containers properly.

Fertilizers

Fertilizers and pesticides are often overapplied because they produce high yields, are easy to apply, and are relatively inexpensive (see Table 1). However, there are several toxic waste metals in some fertilizers (not found on labels), as well as other detrimental effects on water quality and the environment.

Table 1: Comparative Chemical Application Rates in Pounds/Acre/Year in Maryland

Chemical	Cropland	Golf Fairway	Greens	Home Lawn (do it yourself)	Home Lawn (lawn service)
Nitrogen	184	150	213	44 – 261	194 – 258
Phosphorus	80	88	44	15	no data
Pesticides	5.8	37.3	45.1	7.5	no data

Source: Schueler & Holland, 2000

Methods to Reduce Fertilizer Runoff

Listed below are several methods and alternatives that can be used to reduce the amount of fertilizer applied. Following these recommendations will lessen the potential for fertilizer runoff and water quality degradation.

- Apply fertilizer to target the species in the application area.
- Reduce leaching by applying fertilizers at a rate equal to plant uptake. Apply small quantities of fertilizer several times during the growing season.
- Substitute natural or slow release organic fertilizers for inorganic products. If using an inorganic product, choose those with a slow release formula.
- Use a mulching mower and cut no more than the top third of the grass. Grass clippings from mowing the lawn contain many of the nutrients that fertilizers provide.
- Do not overapply the amount of fertilizer. The application rate appears on the label. It is recommended that fertilizer application rates be based on soil test results.
- Never apply fertilizer on a windy day or before a storm event is expected.
- Avoid getting fertilizer on driveways, sidewalks, and streets. These areas typically will drain to storm water conveyance systems. Above all, fertilize carefully. Don't let your fertilizer application get into lakes, streams or ponds.

Runoff from unused phosphorus in lawn fertilizer moves across lawns, roads and woods into streams and ditches, and eventually into reservoirs and lakes. The majority of Indiana soils already contain adequate amounts of phosphorus for a healthy lawn, so most lawns don't need the extra food.

The solution to phosphorus runoff is to control the source. Using phosphorus-free lawn fertilizer is one easy way anyone can contribute to better water quality—regardless of where you live. When shopping for lawn fertilizer, look for the three numbers on the lawn fertilizer bag. The middle number indicates the phosphorus content of the fertilizer, so look for a zero. The other numbers indicate the amount of nitrogen (first number) and potassium (third number) in the fertilizer. Phosphorus is needed only on newly seeded lawns or where soil testing indicates a deficiency.

Crews that apply fertilizers for businesses, commercial operations, or governmental agencies should be trained in the proper application and handling of fertilizers.

PESTICIDE & FERTILIZER APPLICATION

Cost Considerations

The methods described above are very cost effective and can significantly reduce the amount of pollutants introduced into a watershed. Adopting these measures often requires a change in behavioral attitudes which is typically accomplished through the development and implementation of education and outreach programs. The initial cost spent to reduce chemical pollution of the watershed will be recouped by the money saved from trying to treat polluted runoff.

Additional Information

Internet Keyword Search:

suburban pesticides, suburban fertilizers, pesticide alternatives, lawn fertilizer, fertilizer application

Recycling



Recycling programs seek to encourage the reuse of materials through community involvement in recycling. Recycling reduces the demand for raw materials, saves energy, and conserves resources. The more convenient recycling is to people, the higher the participation rate. As a result, organized recycling programs are often the best way to encourage participation.

Recycling programs offer many benefits to the environment. From a water quality perspective the recycling of industrial wastes minimizes the risk of water contamination from the storage and disposal of the wastes. Domestic recycling

encourages responsible disposal of both recyclable and nonrecyclable items which can result in less trash being discarded on the streets and being washed into the waterways. The recycling of products such as batteries is especially good because they contain toxic chemicals which may leach into the waterways when disposed of improperly. Keep leaves, grass clippings and soil out of streets and gutters. Compost leaves and clippings on site, bag them for collection or use a community compost program. Composting yard wastes and leaves is a good way to create topsoil for a community. Equally important, recycling programs raise awareness of the benefits of minimizing and reusing waste.



Application

Residential Recycling

There are several types of recycling programs—residential, industrial, and process and manufacturing recycling. Residential recycling focuses on the recycling of domestically produced wastes. Industrial recycling focuses on the recycling of industrially produced byproducts. This can be a cooperative effort in which two industries exchange byproducts or it can be an individual effort where one industry sells or gives a byproduct to another industry. Processing and manufacturing recycling programs attempt to incorporate byproducts of a process back into the process. The following discussion will focus on collection-based recycling because it is the simplest and most commonly encountered recycling program and lends itself well to community involvement.

Residential recycling programs, sometimes referred to as recycling collection programs, are staffed either by government agencies or private haulers. These programs provide collection and distribution of recyclable goods. The following table lists and summarizes some of the more common types of collection-based recycling programs.

Table 1: Types of Collection Recycling Programs

Government-Staffed Collection Programs Government agencies staff programs which provide curbside, drop-off, or other methods of collection. These programs usually incorporate education, market development, and other activities supporting the collection program. These programs may or may not include privately based contractors.
Hauler-Based Collection Private companies provide recycling collection services to residential, commercial, and industrial waste generators. Sometimes these services are provided under contract with municipal or state governments.
Disposal Facility-Based Collection Establishments which operate solid waste disposal facilities such as incinerators, landfills, transfer stations, and recycling centers where recyclable material is segregated from disposable material provide services which include sorting, baling, grinding, and compacting recyclables for wholesale distribution.

Source: Northeast Recycling Council, Inc., 1998

Additional Information

Internet Keyword Search:

recycling, recycling incentives, recycling programs, curbside recycling

MANAGEMENT & MAINTENANCE ACTIVITIES

Street Cleaning



Mobile sweepers vacuum pollutants and debris from paved areas. The effectiveness of mobile sweepers at removing sediment and trash from paved areas has increased over the last decade to the point that it now represents a viable solution to controlling nonpoint source pollution.

Sediment accumulated on paved surfaces (streets, parking lots, etc.) is a major source of nonpoint source pollution during storm events. Pollutants include sediment particles, debris, trace metals, excess fertilizers from lawn applications, trash, and road salt. Without appropriate storm water quality measures these pollutants can be flushed into streams during storm events. Implementing a street-cleaning program can significantly reduce the amount of nonpoint source pollutants that enter surface waters.

Application

Street cleaning is well suited to urbanized areas where the use of structural storm water quality measures are limited due to the availability of land or the inability to retrofit existing infrastructure. Typical application for a street cleaning program includes streets and parking surfaces associated with residential areas, city/municipal streets, commercial businesses, and industrial sites. Municipal, county, and state agencies may also consider this measure at rest areas and maintenance facilities.

There are a variety of sweepers available commercially. The four most common types of sweepers (U.S. Department of Transportation, Federal Highway Administration, 2002, May) are listed below:

Mechanical Sweepers

This is the most common type of sweeper utilized in the United States. This sweeper utilizes a rotating broom to remove particles and other debris from the paved surface. This method also incorporates a water spray to reduce dust. Water is sprayed in front of the sweeper and particles and other debris are picked up by the rotating broom and carried on a conveyor belt to a storage hopper.

Vacuum-Assisted Sweepers

This sweeper also utilizes a broom to remove particles and other debris from paved surfaces. The operation is similar to the mechanical method by using water to reduce dust. The primary difference between this sweeper and the mechanical sweeper is that the broom directs the particles and debris in the path of a vacuum that transports the material to the storage hopper. The overall efficiency of the vacuum-assisted sweeper is generally higher than a conventional mechanical sweeper.

Regenerative Air Sweepers

Sweeping and removal of particles and debris are achieved through blowing air onto the paved area and immediately vacuuming the material. The materials that are captured are directed to the storage hopper.

Vacuum-Assisted Dry Sweepers

The mechanical operation of these sweepers is completely dry. A specialized rotating brush is used to scratch and loosen particles and dust from the paved surface. The sweeper has a continuous filtration system that collects and retains very fine particles. The filtration system prevents the formation of dust trails that are commonly associated with mechanical sweepers.

Efficiency

Vacuum-assisted sweepers and regenerative air sweepers are typically more efficient than conventional sweepers at removing finer particles. The particles are also more likely to bind with heavy metals, improving the overall performance for pollutant removal. However, the vacuum-assisted dry sweepers have demonstrated a higher removal rate for particles with an aerodynamic diameter less than or equal to ten microns. These sweepers are also designed to meet national ambient air quality standards.

The overall efficiency of sweepers can be optimized by operating at speeds of six to eight miles per hour. It is also critical that brushes are properly adjusted for rotation as per the recommendations of the manufacturer. Sweeping patterns should also be taken into consideration when developing a sweeping program. Generally, two passes per run should be conducted, which will result in the removal of up to 75 percent of total solids present before the sweeping (U.S. Department of Transportation, Federal Highway Administration, *Fact Sheet—Street Sweepers*).

Frequency of Sweeping

In addition to the type of sweeper purchased, the frequency of sweeping also impacts the effectiveness of sweeping programs to diminish nonpoint source pollutants during storm events. An effective street sweeping program can remove several tons of debris annually from city streets (U.S. EPA, NPDES, Pollution Prevention/Good Housekeeping for Municipal Operations, Parking Lot and Street Sweeping, 2007). The Federal Highway Administration estimates that 30 percent removal of dirt can be achieved with a sweeping interval of less than two times the average interval between storms. To achieve 50 percent, sweeping must occur at least once between storms (U.S. Department of Transportation, Federal Highway Administration, 2002, May). In cold climates it is suggested that areas be swept as early as possible in the spring to clean up salt and sand used for winter street maintenance before spring rains wash away this material. A second sweeping should take place in the fall to collect leaf litter.

Regardless of sweeping frequency, it is important to remember that storm water flushes sediment and debris from paved areas into streams, so tailoring your sweeping plan to minimize the amount of sediment and debris present during periods of high precipitation is key. In addition, training in proper sweeping techniques, parking restrictions, and increased concentration on areas of high traffic weigh heavily in the success of sweeping operations. It is better to sweep less frequently, doing a more thorough job, than to sweep more frequently with diminished effectiveness.

Key Considerations

Following are key considerations when designing and implementing a sweeping program to maximize removal of pollutants.

- Emphasize sweeping during wet seasons, or periods of greater precipitation.
- Sweep as close to the curb as possible; this is where dust and dirt collect.
- Impose parking controls during sweeping hours or sweep at times when vehicle obstructions are minimized.
- Sweep heavy traffic areas more frequently.
- Staff and operators should be adequately trained.
- The frequency of sweeping and routes should be selected to optimize efficiency.
- Reduce sources of pollutants. Utilize source controls that include but are not limited to public education and signage.
- Properly dispose of materials collected during sweeping operation. Disposal of all materials should be in accordance with all state and federal regulations.

Federal and state regulations may allow for the reuse of materials collected for fill or other applications. Screening and separation of the materials is required before reuse. Entities considering this option should check with the state regulatory authority.

Cost Considerations

Costs can vary depending on what type of sweeper is chosen, the frequency of sweeping, and the number of sweepers needed. It is important when weighing the costs to realize that higher-priced equipment may be justified by more efficient cleaning and longer usable life spans. A thorough cost analysis should be performed in order to implement the best program for a given budget. Aspects that should be included in every thorough cost analysis are the costs of training, maintenance, material disposal, and labor.

Additionally, these costs should be normalized with information on the efficiency of the sweeper, the targeted particle size, the amount of pavement which can be thoroughly cleaned by each type of sweeper, and the seasonal use restrictions for each model.

Additional Information

Internet Keyword Search:

street sweeping, municipal street cleaning, mechanical sweeper

MANAGEMENT & MAINTENANCE ACTIVITIES

Road Deicing



Snow and ice removal is an important pavement management practice in areas subject to these conditions. Traditionally there are two methods employed in the removal of ice and snow—mechanical means such as plowing and the use of chemical deicing agents. Deicing agents are chemicals or

compounds designed to melt snow or ice on highways. The most frequently used deicing agents are simple salts such as sodium chloride and calcium chloride because they are less expensive than more sophisticated deicing agents. They are applied to roads during conditions of snow and ice. When the snow melts these materials are deposited on the road surface and can be washed into surface waters by storm water runoff. Every year the United States uses between 8 and 12 million tons of salt for deicing purposes and much of it reaches the waterways and ground water. In addition to being corrosive to the frames and body panels of cars, salt has many negative effects on water quality and the environment.

Negative Effects of Salt on the Environment

- Can damage and kill vegetation.
- Depletes oxygen level in waterbodies as it degrades.
- Disrupts ecology of waterbodies.

Application

Types of Deicing Agents

There are several commonly used deicing agents. Each of them has advantages and disadvantages making them best suited for uses under differing conditions. Sodium chloride is the most widely used deicing agent because it is the least expensive. Calcium chloride is the most attrac-

tive alternative to sodium chloride because when applied in liquid or pellet form it is less corrosive, fast melting, and only 10 to 15 percent more expensive. It also works better in extremely low temperatures. Table 1 summarizes the characteristics of some of the more commonly used deicing agents.

Alternatives to Deicing Agents

Removing snow prior to compaction by pedestrian or automobile traffic is essential to preventing it from turning into ice. Prompt removal of snow can often negate the need for deicing agents. Mechanical removal can be accomplished using loaders, brushes, or shoveling. The mechanical removal of snow is especially applicable to parking lots, rooftops, and pedestrian walks and should be incorporated into storm water management plans.

Minimizing Environmental Impact

Good management practices and careful site evaluation can minimize the environmental impact of deicing agents. There are two main considerations in regard to deicing agents—application and storage. The most important of these considerations is storage. Deicing agents should be stored in structures or containers that will isolate the material from the weather and storm water runoff (see Figure 1). Table 2 on page 20 lists some suggestions for minimizing the risk of these agents contaminating surface water.

Figure 1: Salt Storage Facility



During storage, road salt should be covered to prevent salt from lumping together or being lost with storm water runoff.

Table 1: Characteristics of Commonly Used Road Deicers

	Sodium Chloride (NaCl)	Calcium Chloride (CaCl)	Potassium Chloride (KCl)	CG-90 (a corrosion-inhibiting salt)	Calcium Magnesium Acetate (CMA) $\text{CaMgCO}_2\text{H}_3\text{O}_2$
Soils	Cl complexes and releases heavy metals; Na can break down soil and decrease permeability.	Cl complexes; Ca can exchange with heavy metals and increase soil aeration and permeability.	Cl complexes; K can exchange with heavy metals.	Same as NaCl, Mg can exchange with heavy metals.	Ca and Mg can exchange with heavy metals. Ca increases soil aeration and permeability.
Effects on Vegetation	Salt spray and splash can cause leaf scorch and kill new plant growth up to 50 feet from the road. Osmotic stress can result from salt uptake. Grass is more tolerant than trees and woody plants. NaCl, CaCl, KCl and CG-90 deplete oxygen in small lakes and streams when degrading.				Little known effect.
Ground Water	Mobile Ca and Na ions reach ground water and their concentration level can increase during times of low flow. Ca, K and Mg can release heavy metals from soil.				
Surface Water	NaCl, CaCl, KCl and CG-90 can cause density stratification in small lakes with closed basins which can lead to anoxia (lack of oxygen) in lake bottoms; often contain nitrogen, phosphorous, and trace metals as impurities; and often occur in concentrations greater than five parts per million.				Can cause oxygen depletion in surface waters.
Minimum Operating Temperature	12° F	-20° F	-----	1° F	23° F
Comments	Most widely used deicing agent.	More effective, lower operating temperature; much more expensive than NaCl; most often used in low temperature conditions.		Provides some corrosion protection, cost competitive, effective at lower temperature than NaCl.	Very expensive, works at slower rate; less efficient so it requires more storage space; most often used on bridges because of low corrosiveness.

Source: Center for Watershed Protection, Stormwater Manager's Resource Center

Table 2: Minimizing the Risk of Water Contamination

Storage <ul style="list-style-type: none">• Salt storage piles should be located on impervious surface and completely covered.• Runoff from storage piles should be contained in an appropriate area.• Spills should be cleaned up after loading operations.
Application <ul style="list-style-type: none">• Amount of deicer applied should be adjusted to traffic volume and road conditions.• Trucks should be equipped with ground-speed sensors which adjust spreading rates according to speed.• Salt truck drivers and handling personnel should attend training programs to improve spreading efficiency and reduce losses of material.• Drivers should avoid plowing snow from treated surface into piles near waterways.
Additional Suggestions <ul style="list-style-type: none">• Identify ecosystems which might be sensitive to salts and use calcium magnesium acetate in these areas.• Apply sand to help traction and reduce the need for deicing agents.• Match deicing agents to pavement temperatures to maximize deicing efficiency.• Minimize the use of deicing agents in areas with low traffic volumes.

Source: Center for Watershed Protection, Stormwater Manager's Resource Center

Cost Considerations

The cost of these measures ranges from zero to high. Simply reducing the amount of salt used will result in money being saved. Using more expensive alternatives to salt can be a high-cost solution. The construction cost of salt storage facilities is high however over time this can result in money being saved because it prevents salt from being lost to rain and snow melt. When developing a plan for responsible use of road deicers it is important to factor in ecological benefit, magnitude of cost increase, and effect on public safety.

Additional Information

Internet Keyword Search:

road deicers, road salt, environmental effects of road salt, road salt storage, road salt alternatives, road salt use reduction

MANAGEMENT & MAINTENANCE ACTIVITIES

Domestic Animal Waste



Waste from geese, cats, dogs, and other domestic animals is an often overlooked contribution to poor water quality. The waste from these animals, geese in particular, can result in the nutrient enrichment of waterbodies. As a result, the waste from these animals should be disposed of properly to prevent water quality degradation.

Application

Responsible pet owners should pick up after their pet(s); laws in some cities require this. Developments often have designated toileting areas for dogs and may even provide bags to dispose of waste deposited in these areas. Owners of cats, guinea pigs and other indoor animals should double bag waste from the litter box or cage and dispose of it in containers designated for animal waste disposal. This will prevent other residents from being exposed to the waste. When walking dogs, pet owners should take bags with them to pick up any waste left by their dog. Devices exist to assist owners in this process.

While many people enjoy seeing Canada geese in flight, problems can occur when too many geese concentrate in one area. Typically, developers, homeowners, and other landowners unknowingly cause the problem by creating ideal goose habitat. Geese are grazers and feed extensively on fresh, short, green grass. Add a permanent body of water, such as a retention pond, adjacent to their feeding area and you have created the perfect conditions for geese to set up residence, multiply, and concentrate.

Modifying the habitat of existing areas and designing water areas with the use of different types of vegetative cover, rocks and fences can greatly reduce problems with too many geese. Avoid the use of turf grasses near water areas. Using a combination of warm season grasses, wild flowers, wetland plants, legumes, shrubs, and trees will create an aesthetically pleasing environment for residents,

DOMESTIC WASTE

reduce maintenance costs (such as weekly mowing), better control soil erosion on pond banks and improve the habitat for other wildlife that will not become a nuisance. For more information on beneficial habitat modifications and controlling geese, contact the Indiana Department of Natural Resources, Division of Fish and Wildlife or visit IDNR's Web site at www.IN.gov/dnr/fishwild/.

When planning a community ordinance it is important to include waste disposal from domestic animals as one of the provisions. Some cities require that pet owners pick up after their pet, however it is beneficial to include it as a community rule as well. This will ensure that residents comply with the meas-

Cost Considerations

The cost of these measures is medium to low. Providing an area for dogs to use is dependent upon land prices. However, the benefits of this measure include a more sanitary living environment, lower groundskeeping costs, and a cleaner residential community. Providing separate containers for disposal of waste from domestic animals is an inexpensive measure and will prevent other residents from coming in contact with the waste.

Additional Information

Internet Keyword Search:

domestic animal waste disposal, animal waste disposal regulations

MANAGEMENT & MAINTENANCE ACTIVITIES

Vehicle & Equipment Maintenance & Washing Areas



Using environmentally sound measures when maintaining and washing vehicles and equipment can prevent the contamination of ground and surface water by substances (such as oil, antifreeze, solvents, etc.) typically associated with runoff from these areas. Storm water quality management measures needed to reduce pollution from vehicles and equipment maintenance and washing apply not only to businesses, industry, construction, and municipal fleets, but also to the general public. The implementation of simple best management measures can give a large cumulative benefit in terms of pollution prevention.

Application

Table 1 lists common problem areas involved with vehicle and equipment maintenance and washing. Compliance with local regulations and implementation of basic storm water management measures can protect human health and the environment from substances removed during vehicle and equipment maintenance and washing. The measures involved are derived mostly from common sense and maintaining a clean work environment. The storm water management measures listed below are very effective at reducing discharges of untreated vehicle wastes and wash water to the watershed.

Table 1: Potential Sources of Pollutants from Vehicle Maintenance and Washing Areas

Potential Storm Water Contamination Source	Potential Problems	Potential Pollutants
Maintenance Area	Fluid spills during maintenance activities; fuel leaks during fueling	Gasoline, waste fuel, used lubricants, battery acid, coolants
Washing Area	Leaking fluids from vehicles; wastewater from cleaning and washout activities	Sand, lime, silicates, waste fuel, admixtures, wastewater, gasoline

Source: U.S. EPA, 2000

VEHICLE & EQUIPMENT MAINTENANCE & WASHING AREAS

Specifications for vehicle and equipment maintenance storm water quality management measures will vary based on the company involved (i.e., small business, industry, fleet, etc). Larger operations will need to implement more structural changes to accommodate the large amount of vehicle maintenance and washing that occurs. Conversely, small businesses and residences may only need to make small changes and use common sense. The following storm water quality management measures and structures are summarized under three categories—maintenance, fueling, and washing and cleaning.

Vehicle and Equipment Maintenance Management Measures

- Establish a schedule to inspect all vehicles and equipment for leaks.
 - Inspect and clean equipment regularly to prevent leaks and excessive buildup of contaminants.
- Conduct vehicle and equipment maintenance at one location away from storm drains.
- Cover maintenance areas with a permanent roof to help minimize storm water runoff.
- Use drip pans and drop cloths to catch drips and spills when draining or replacing motor oil, radiator coolant, or other fluids.
- Avoid using water to clean work areas. Try to use dry methods to clean up materials. Clean small spills with rags, larger spills with absorbent material.
- Use nontoxic substitutes for chemicals where possible.
- Do not use storm drains for disposal of materials.
 - Store recyclable materials (oil, batteries, etc.) for proper disposal.
 - Wherever possible, connect equipment processing areas to a sanitary sewer or wastewater treatment facility.
- Recycle greases, oil and filters, antifreeze, cleaning solutions, batteries, and transmission fluids through proper disposal agencies.
- Buy recycled engine oil, engine coolant, tires, and other vehicle parts when possible.
- Train employees on reducing pollutant discharge, spill prevention, and cleanup.
 - Be sure that employees are aware of all illegal actions associated with pollutant disposal.

Vehicle and Equipment Fueling Management Measures

- Cover fueling areas to help intercept precipitation and reduce storm water runoff.
- Pave fueling areas with concrete rather than asphalt (gasoline deteriorates asphalt).
- Design fueling areas to drain inward to a sump or an oil-water separator.
 - Perimeter drains can be installed as an alternative to inward-draining areas.
- Discourage “topping off” fuel tanks and install vapor recovery nozzles to control drips.
- Where appropriate, use drip pans to catch spills.
- Clean up spills immediately to minimize safety hazards and prevent spreading.
- Mop up small spills or use absorbent materials. Remove absorbent material promptly.
- Transport industrial equipment to a designated fueling area rather than using mobile fueling.
- Make sure that all employees are trained in proper fueling and cleanup procedures.

Vehicle and Equipment Washing and Cleaning Management Measures

- When possible, use commercial washing and cleaning facilities that employ proper pollution control measures.
- If you cannot use a commercial car wash, use a bucket (not a running hose) to wash and rinse vehicles to conserve water and reduce runoff.
- Use designated wash areas (preferably covered). Use bermed wash areas or other measures to contain wash water (see Table 2).
- Stabilize entrances and on-site roads to reduce off-site transportation of sediments.
- Designate a paved washing site for vehicles where the water will drain down slope.

VEHICLE & EQUIPMENT MAINTENANCE & WASHING AREAS

- Divert wash water to a vegetated area so it can percolate into the ground.
- Or, use at-grade storm drains fitted with inserts. Inserts hang down into a drain's catch basin to filter out solids and other pollutants from rinse-water runoff. Trapped materials can be removed or the inserts replaced.
- Wash vehicles with biodegradable, phosphate-free detergent.
- Use nontoxic cleaning products.
- If possible, use “dry” cleaning methods (such as wiping down) rather than hosing equipment.
- Avoid pressure washing on site if commercial washing facilities are available. If commercial facilities are not practical, design a pressure-washing area that can capture and properly dispose of or recycle all of the wash water. Use high-pressure, low-volume washers to reduce overspray.
- When multi-stage washing is practiced, wash and rinse waters can be recycled by reusing the water from the final stage for the first prewash and rinse stage.
- Properly contain, label, and dispose of cleanup materials (rags, towels, absorbent materials).
- Train employees on proper washing methods.

Structural Control of Storm Water Contamination

Moderate to large-sized operations can surround potential contamination areas with containment diking or curbing. These are temporary or permanent methods of separating the activity area from storm water runoff and containing any pollutants within the structure (see Table 2). Diking and curbing can be constructed out of the same impermeable materials (earth, concrete, asphalt, plastics, etc.) and the terms are sometimes used interchangeably. Diking is usually considered larger than curbing, and includes such structures as retaining walls and earthen and concrete berms. Very small, isolated point sources of potential contamination can be contained by a simple drip pan system.

Cost Considerations

As shown in Table 2, simple methods such as common sense, education, and containment are very effective techniques for reducing storm water pollution. Costs associated with vehicle maintenance and wash areas include building covered or enclosed structures, establishing approved connections to a sanitary sewer system, grading wash areas to drain to sanitary sewers, and increased labor costs associated with special handling of hazardous wastes. The installation

VEHICLE & EQUIPMENT MAINTENANCE & WASHING AREAS

of containment structures such as berms, dikes, and curbs, while expensive at first, generally become much less expensive in the long run as pollution is reduced. The cost of wash water containment equipment is usually a one-time expense, and this equipment can be used for a number of years. Recycling and reuse of materials also decrease cost expenditures.

Table 2: Spill Containment Methods

	Application	Limits	Design Parameters	Maintenance
Containment Dike	<ul style="list-style-type: none">• Can contain larger spills than curbing.• Containment allows proper disposal or recycling of polluted materials.	<ul style="list-style-type: none">• Most expensive construction costs.• Relatively high maintenance.• With larger volumes contained, pollutants may infiltrate into ground water.	<ul style="list-style-type: none">• Capable of holding an amount equal to any single spill, and keeping out runoff events.• Material strong enough to safely hold spilled materials (dependent on size and type of potential spills).	<ul style="list-style-type: none">• Regular structural maintenance.• Inspect after storm events for overflows.• Treat polluted water before release.• Maintenance of any mechanical parts (e.g., pumps).• Earthen berms must be seeded and the vegetation cover maintained regularly.
Curbing	<ul style="list-style-type: none">• Smaller-scale applications.• Containment facilitates proper disposal or recycling of polluted materials.	<ul style="list-style-type: none">• Not effective for holding large spills or runoff events.• Requires maintenance.	<ul style="list-style-type: none">• Smaller containment area requires special attention to keep spills away from contact and tracking by employees.	<ul style="list-style-type: none">• Regular maintenance to prevent overflow.• Regular structural inspection and repairs.• Prompt cleanup of spills.

Source: Idaho Department of Environmental Quality, 2001; Pierce County, 2002

Additional Information

Internet Keyword Search:

maintenance areas, vehicle washing areas, municipal maintenance operations, carwash facilities

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EDUCATION & PUBLIC OUTREACH

As noted in the Management & Maintenance Activities introduction on page 5, pollutants can be reduced through project management, operational procedures, and program implementation. These source controls focus on activities that limit the generation of pollutants at the source rather than the treatment of runoff.

This section of the manual provides public education and outreach source control activities that can be used to achieve pollution prevention. Education and public outreach efforts should be used to educate both youth and adults. Educational programs should focus on creating an understanding of how everyday activities contribute to storm water pollution. Education and public outreach can be achieved through public meetings, school programs, adoption of highways and waterbodies, storm drain marking, and other similar programs.

Source controls should be part of an integrated storm water management program. They should not be substituted for the implementation of effective permanent storm water quality measures.

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Public Participation

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Education



Creating a successful urban storm water management program will require the cooperation of the general public. In order to achieve their cooperation, the general public needs information on what causes pollution, indicators of water pollution, and what they can do to reduce and/or prevent further storm water

pollution. Surveys in Wisconsin have shown that most people do not understand the impacts of urban storm water runoff on water quality. To a large extent the public is unaware of solutions to the pollution problem (see Figure 1). However, there is still a willingness, even from an uneducated public, to support pollution cleanup programs (see Figure 2). A large part of the pollution problem arises because the public is not aware of the impact their actions have on the environment. A simple diagram such as Figure 3 could make the public aware of how to properly dispose of common pollutants found in storm water, thereby decreasing the likelihood of improper disposal of materials into the storm water system. It has been shown that the public can be either helpful or detrimental to the success of storm water management programs, since individual activities play a leading role in reducing storm water impacts in urbanized areas. The key behind getting strong public support begins with education and outreach programs to make the public aware of the problem and potential solutions.

Figure 1: General Public's Knowledge of Storm Water Control

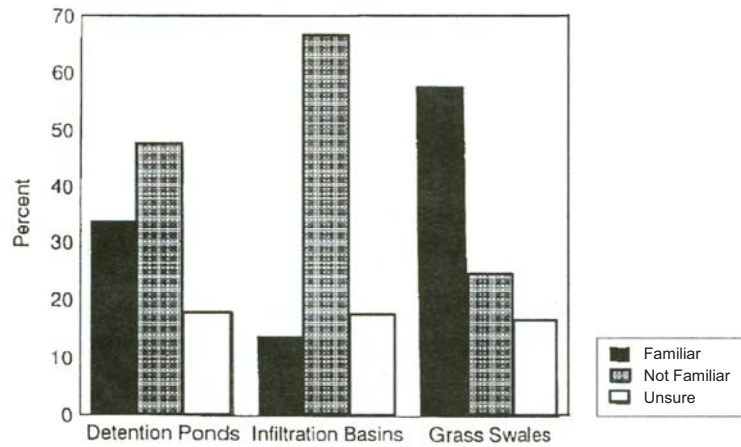
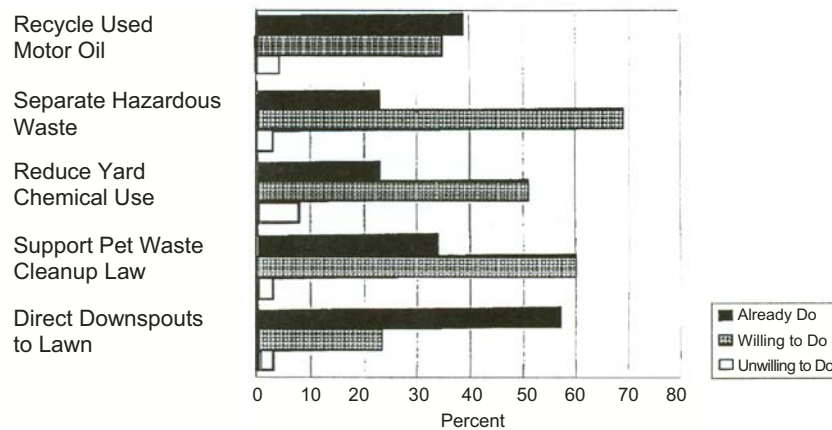





















































Figure 2: Public's Willingness to Partake in Pollution Prevention Practices



Source: Nowak, Peter J. 1990. "Water Quality in the Milwaukee Metropolitan Area: The Citizens' Perspective." University of Wisconsin Environmental Resource Center. Madison, Wisconsin.

Figure 3: Household Waste Disposal Guide

Kitchen, Bathroom & Household	Garage & Workshop
Aerosols (empty) 	Antifreeze  
Batteries (alkaline)  	Auto Batteries  
Batteries (containing mercury) 	Brake Fluid  
Batteries (rechargeable) 	Epoxy, Fiberglass 
Cleaners (tub, tile, ammonia based, etc.) 	Gasoline, Diesel, Fuel Oil 
Cosmetics 	Metal Polish 
Empty Solvent/Cleaner Containers (dry) 	Mineral Spirits 
Expired Medicine 	Motor Oil  
Fats, Oils, Grease 	Paint (latex, oil, lacquer) 
Glue (water based) 	Paint Thinner, Strippers 
Glue (with solvents) 	Putty, Grout, Caulking 
Hair Relaxer 	Rust Remover 
Hairspray, Other Aerosols 	Transmission Fluid  
Insect Poison/Bug Spray 	Varnish 
Lighter Fluid 	Windshield Washer Fluid 
Moth Balls 	Wood Preservatives 
Nail Polish & Remover 	
Oven Cleaner 	
Rubbing Alcohol 	
Permanent Lotions 	
Septic Tank Degreasers 	
Shoe Polish 	
Toilet Bowl Cleaner 	
Window Cleaner 	
	Garden
	Fertilizer (with weed killer) 
	Fertilizer (without weed killer) 
	Herbicides 
	Pesticides 
	Rat/Mouse/Gopher Poison 

Key



This symbol represents products that can be safely poured down the drain or flushed in the toilet with plenty of water. Homeowners using septic tanks should consider alternate disposal and try to purchase these items sparingly.



This symbol represents products that can be safely disposed of in the garbage.

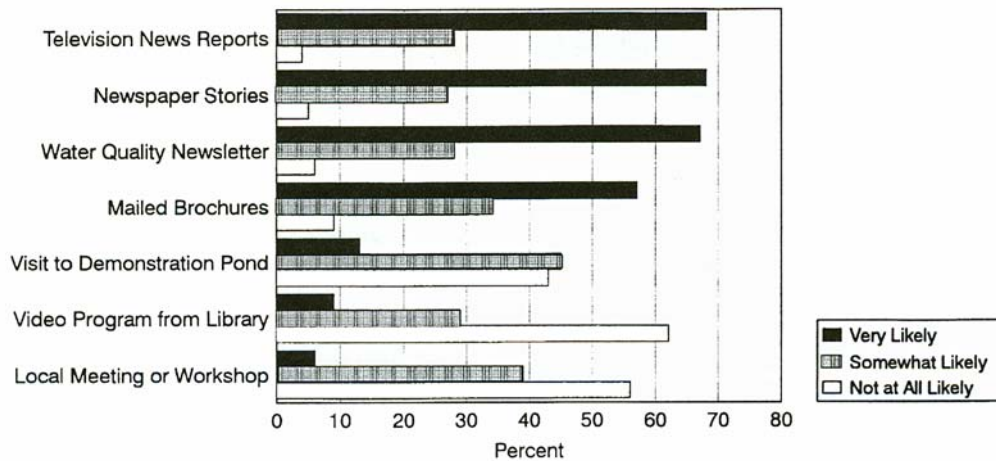


This symbol indicates you should contact your local household hazardous waste program for proper disposal instructions.



This symbol represents products that should be recycled.

Figure 4: Success of Media in Catching Public's Attention



Source: Nowak, Peter J. 1990. "Water Quality in the Milwaukee Metropolitan Area: The Citizens' Perspective." University of Wisconsin Environmental Resource Center. Madison, Wisconsin.

Application

Education Programs

Education of the general public is a shared responsibility, and for that reason it is often neglected. Therefore, the first and foremost goal of any storm water management program should be the formation and implementation of an education and outreach program. Table 1 describes the steps involved and gives examples of how to form an all-encompassing educational program.

There are several benefits to having a well-informed public.

- Citizens who understand what behaviors cause decreases in water quality and the effect of poor water quality in the community are less likely to perform acts that have negative impacts.
- An aware public is much more likely to notice and alert the proper authorities to potentially serious problems within the system. A pollution hotline could be put into effect so hazardous materials spills can be dealt with quickly before the problem becomes catastrophic.
- Public education can be integrated into educational components of private organizations and groups that will hopefully become proactive in maintaining a healthy storm water system.
- Opportunities to create community activities and links with the local government are formed. Coordinated programs regarding storm water pollution prevention activities could include things like stream monitoring, stream clean-ups, adopt-a-stream programs, tree planting days and storm drain stenciling.

Table 1: Development of an Education Program

Steps	Description	Examples
Targeting Audience	Financial and labor limitations make it necessary to target audiences. Prioritize by targeting those with the most impact on managing urban storm water.	<u>Public That Must Act</u> <ul style="list-style-type: none"> Government officials, developers, owners of industrial property, and urban residents. <u>Public Actively Supporting Change</u> <ul style="list-style-type: none"> Local government associations, service groups, environmental groups, water resource groups, concerned citizens. <u>Future Supporters</u> <ul style="list-style-type: none"> Youth, teachers, general public.
Identifying Issues	Focus on single issues that are relevant to the local community. Cover only a few issues each year to avoid overwhelming the public and making the problems seem impossible to solve.	<u>Urban Runoff</u> Impacts on water quality and recreation, source of pollutants, effective solutions. <u>Pollution Prevention</u> <ul style="list-style-type: none"> Pesticide and fertilizer application. Clipping and leaf disposal. Pet waste cleanup. Sweeping streets and parking lots. Automotive care, disposal of used motor oil.
Distribution of Information	Information pertaining to pollution and their environment must be distributed and made available to the general public for education to occur. More people learn by everyday media than through special workshops (see Figure 4).	<u>Methods to Distribute Information</u> <ul style="list-style-type: none"> Brochures and fact sheets. Utility bill inserts. Internet Web site. Education programs. Special events or workshops. School curricula. Volunteer educators.
Selecting Appropriate Activities	Effective activities must be catered towards the audience, their interests, and the topic being discussed.	<u>For Example</u> <ul style="list-style-type: none"> Dog owners are more interested in pet waste topics. School children are interested in community problems with fun, hands-on learning activities.
Measuring Success	All education programs need evaluation to measure the effect of the program. Evaluations will show what techniques worked and what still needs revision.	<u>Evaluation Indicators</u> <ul style="list-style-type: none"> Number of people effected by the program. Reactions of people to the issues. What people learned (pretest/post-test). How people acted on that knowledge. Improvement in water quality regarding issues dealt with during that year.

Tips for an Education Program

- The education program should be given specifically to someone responsible for designing and implementing the program.
- Choose only a few important topics relevant to the community to do each year. Too much information can be overwhelming and discouraging to the public.
- Target the audiences with the largest impact on water quality first and cater your program to their interests in order to make them more receptive.
- Start with the basics of understanding the problem and how their actions can impact whether this pollution problem is solvable or is going to heavily impact the community in the future. Tell them specifically what, when, how, and where they can participate in preventing or cleaning up pollution.
- Spend the money necessary to achieve high quality. In the long run, preventing pollution problems rather than trying to use structural storm water techniques to improve water quality will save more money.
- Keep your messages simple. Often, the public will ignore messages that are too long or hard to understand. Start small to grab their attention, then as their interest and awareness increases, so too can the messages.
- Make the messages positive. Make them believe individuals can make a difference, because they can. Also, they need to believe their participation is improving their standard of living, as well as the environment.
- Repeat the message. Messages must be repeated several times from credible sources before people will start to believe in them.
- Provide feedback. If the public realizes what a positive, large impact they have made on the environment, they will be more than willing to put more effort into storm water pollution prevention techniques.

Additional Information

Internet Keyword Search:

environmental education, storm water education, local storm water plans

Indiana Resource:

Indiana Department of Environmental Management

Storm Drain Marking



Source: Indiana Project WET, Indiana DNR

Storm drain marking consists of labeling a storm drain inlet with a preprinted marker, tile, sticker, or stencil that reads “Dump No Waste–Drains to River,” “Drains to Stream,” or a similar written message that denotes that storm water entering the drain flows through the enclosed drainage system and discharges to a stream, open drainage channel, or other water body.

Storm drain marking is intended to serve as a visual reminder of the storm drain-to-river connection and give citizens a better understanding of the fate of urban runoff and its effect on water quality. Polluted runoff can

harm Indiana’s waterways which are often used for recreational purposes such as fishing and swimming and as a drinking water supply in many communities. The United States Environmental Protection Agency recommends storm drain marking as a public education/outreach and public participation/involvement activity for municipalities that are required to comply with the 1972 National Clean Water Act National Pollutant Discharge Elimination System Phase II Storm Water Regulatory Program.

Nonpoint source pollution is pollution that originates from many diffuse and difficult-to-identify sources whereas point source pollution originates from a single, traceable source such as a pipe. Rainwater that washes soil, street litter, oil, leaves, grass clippings, pet wastes, and fertilizers into storm drains is classified as nonpoint source pollution. This untreated storm water can pollute the receiving waterway or waterbody. Although individual storm

Figure 1: Trash Collected Around Storm Drain Inlet Grates



Source: Indiana Project WET, Indiana DNR

STORM DRAIN MARKING

drains may contribute small amounts of pollutants, the combination of many storm drains can cause a negative impact on water quality.

Many people do not realize that polluted storm water flowing into a storm drain or chemicals, automotive fluids, and household wastes dumped into a storm drain is not cleaned or treated before it discharges into a river, stream, lake, or other waterbody.

Application

Marking Methods

Adhesive or preglued vinyl curb markers or stenciling are the most common methods used to mark storm drains. The method chosen will depend on a community's needs and budget.

Adhesive or preglued vinyl markers are attractive, quick and easy to apply, last several years, and require little to no maintenance. Stenciling, however, reaches a larger number of people because stenciled messages are not as permanent and require volunteers to come back in a year or two to restencil messages, thereby educating a new group of volunteers.

Who Can Participate

Storm drain marking is an effective service learning or civic learning project for schools, scout groups, homeowner associations, 4-H clubs, municipalities, or any organization wanting to make a positive impact on their community.

While marking the storm drain identifies the issue to the passersby, the real important impact is the marking activity itself. It connects volunteer groups with the watershed and educates them on how human activities impact water quality.

Permission

The first step to a successful storm drain marking program is to obtain written permission. This will usually require contacting the local government entity that manages the storm drain system with the community (e.g., Public Works Department). Storm drain marking done on private property such as business parking lots will also require contacting and obtaining permission of the landowner(s).

Supplies

The selection and quantity of supplies for storm drain marking will depend on the method chosen and the number of storm drains to be marked. Following is a general list of supplies that are essential to conducting a safe and effective storm drain marking program.

STORM DRAIN MARKING

- Safety vests or brightly colored t-shirts.
- Wire brush or broom (for surface preparation).
- Dust pan.
- Garbage bags.
- Safety cones.
- Marking materials.

It is also important to keep in mind that each work group will need their own set of supplies.

Site Preparation & Installation

Proper surface preparation is key to any storm drain marking program. Surfaces must be in good condition, free of loose material, grit, and dirt, etc. and must be clean and dry for paint or an adhesive marker to properly adhere to the surface. As always, it is important to read and follow the manufacturer's directions and recommendations when applying the storm drain marking.

Additional Information

Internet Keyword Search:

storm drain marking

Indiana Resource:

Storm Drain Marking Manual
www.stormdrain.IN.gov

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REGULATORY PROGRAM IMPLEMENTATION

There are a number of storm water regulatory programs that are administered in Indiana. These programs are focused on both storm water quality and storm water quantity. The state administers two programs that are focused on storm water quality. These programs are:

- **Construction/Land Disturbance Storm Water Permitting
(327 IAC 15-5, Rule 5)**

327 IAC 15-5 is a performance-based regulation designed to reduce pollutants, principally sediment, that is a result of soil erosion and other activities that are associated with construction and/or land disturbing activities. The requirements of 327 IAC 15-5 apply to all persons who are involved in construction activity (which includes clearing, grading, excavation and other land disturbing activities) that results in the disturbance of one (1) acre or more of total land area. If the land disturbing activity results in the disturbance of less than one (1) acre of total land area, but is part of a larger common plan of development or sale, the project is still subject to storm water permitting.

- **Municipal Separate Storm Sewer System Permitting
(327 IAC 15-13, Rule 13)**

327 IAC 15-13 regulates municipal separate storm sewer systems (MS4s). MS4s are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying storm water.

Entities designated by the state must develop a local storm water program. The implementation of this program is guided by a storm water quality management plan (SWQMP). The SWQMP must be based on six minimum control measures, including public education, public involvement, illicit discharge and detection, construction/land disturbance runoff, post-construction runoff, and good housekeeping. Several of these measures require MS4s to establish ordinances and enforcement mechanisms.

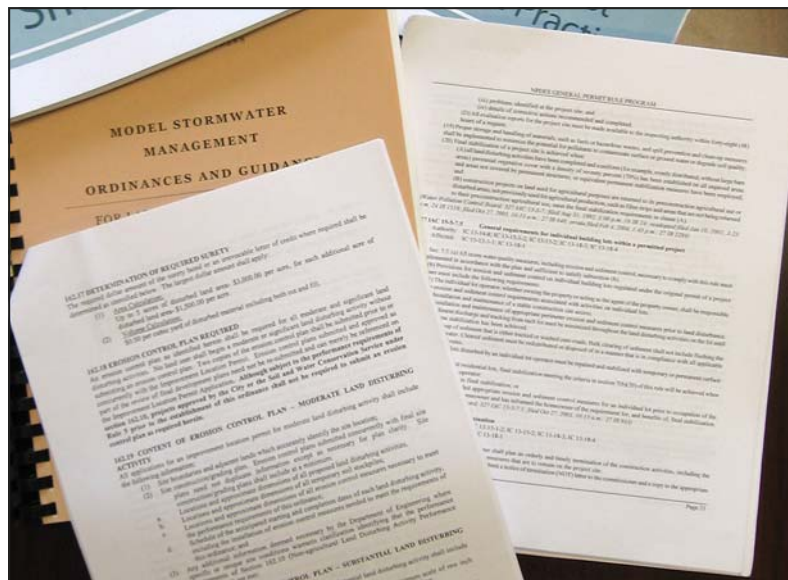
In addition to the programs administered by the state, many communities across the state have taken the initiative to adopt ordinances to address both storm water quality and quantity. These local regulatory programs are typically administered by local units of government including municipalities, counties, towns, and cities.

This section of the manual provides guidance on the development of regulatory programs. This includes the development and implementation of ordinances and the administration and enforcement of storm water regulations.

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REGULATORY PROGRAM IMPLEMENTATION

Ordinances



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REGULATORY PROGRAM IMPLEMENTATION

Compliance & Enforcement



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